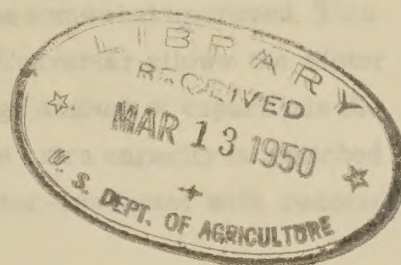
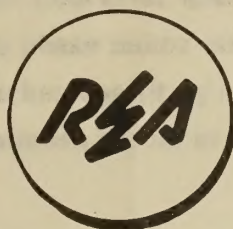


REPORT ON

THE HENRY PHASE CONVERTER

August 1950

U. S. DEPARTMENT OF AGRICULTURE
RURAL ELECTRIFICATION ADMINISTRATION
TECHNICAL STANDARDS DIVISION



REPORT ON THE HENRY PHASE CONVERTER

As the result of numerous requests for information on the Henry Phase Converter the following summary has been prepared.

The Henry Electric Company of Saginaw, Michigan, has announced a series of devices to permit the operation of three phase motors from a single phase power line. These devices are known as the "HENRY PHASE CONVERTERS."

The principle of operation of the device can be summarized as follows:

The usual three phase induction motor can be made to operate as a single phase capacitor-start capacitor-run motor by properly connecting two of the three motor terminals to a single phase source of the proper voltage and by adding a specific amount of capacitance between the third motor terminal and one of the two line wires of the single phase source.

A motor connected as above with a fixed amount of capacitors in series with the third winding would have very poor starting torque. However, if a current sensitive relay were added to the single phase wiring in such a manner to cause more capacity to switch into the circuit for starting purposes, the starting torque can be somewhat improved. This is essentially what the Henry Phase Converter does. The Converter allows the motor to start as a capacitor-start single phase motor with a large amount of capacity in the third winding. After the motor reaches operating speed, the extra capacity is switched out of the circuit and the motor continues to run as a capacitor-run motor with reduced capacity in the third winding.

It is to be noted that the above explanation states that the motor "can be made to operate." This does not mean that the motor will operate with equal efficiency and power output. The motor will generally operate with unbalanced currents in the three windings and have unequal heating of the windings. The phase relationship and magnitude of the currents in the three windings are not the same as they would be if the source were the correct three phase voltage intended for the motor. The following results can be expected when motors are operated under these conditions: Reduction in starting torque; reduction in horsepower output if the motor temperature rise is to be kept within the manufacturer's rating; and uneven heating of the motor caused by the unbalanced currents in the windings.

Certain types of loads do not require the maximum horsepower of the motors driving them. As motors are made in standard sizes, the nearest larger size is generally applied to the requirements of the machine. Some loads do not require high starting torques. Fans, centrifugal pumps, feed grinders and hammer mills (started unloaded) are typical of low starting torque loads. Still other loads such as lathes, drill presses, water pumps, require maximum horsepower for short intervals of time and may be classed as intermittent loads. It is possible to use a phase converter on many of the motors driving such loads without appreciably affecting the operating characteristics of the machines.

The manufacturer of the Henry Phase Converter has indicated that it has only a limited knowledge as to its application. It is definitely not suited for high starting torque loads (the converter limits the starting torque of the motor to about 150% of the full-load torque, the same motor on a three phase supply would have a starting torque of about 300% of the full-load). However, many types of loads can be powered through the phase converter with satisfactory results.

It does not appear advisable for REA borrower cooperatives to purchase phase converters because the three phase output of such converters cannot be considered to be equivalent to conventional three phase service. Each phase converter must be tailored to one specific load.

Insofar as it affects the distribution system, there is no objection to a consumer using a phase converter. It should be emphasized, however, that the phase converter must be properly tailored to the load to get the desired results.

The phase converter should be considered as strictly a consumer device the same as any other appliance or motor.

REA does not recommend the use of consumer devices that do not bear evidence of Underwriters' Laboratories approval. The Henry Phase Converter has not been approved by Underwriters' Laboratories, therefore REA does not recommend its use.

Certain types of loads do not require the maximum horsepower of the motor driving them. As motors are made in standard sizes, the nearest larger size is generally applied to the requirements of the machine. Some loads do not require high starting torques. For example, centrifugal pumps, feed grinders and hammer mills (started unloaded) are typical of low starting torque loads. Still other loads such as lathes, drill presses, water pumps, require maximum horsepower for short intervals of time and may be classed as intermittent loads. It is possible to use a phase converter on many of the motors driving such loads without appreciably affecting the operating characteristics of the machines.

The manufacturer of the Henry Phase Converter has indicated that it has only a limited knowledge as to its application. It is definitely not suited for high starting torque loads (the converter limits the starting torque of the motor to about 150% of the full-load torque, the same motor on a three phase supply would have a starting torque of about 300% of the full-load). However, many types of loads can be powered through the phase converter with satisfactory results.

It does not appear advisable for REA laboratories to purchase phase converters because the three phase output of such converters cannot be considered to be equivalent to conventional three phase service. Each phase converter must be tailored to one specific load.

Insofar as it affects the distribution system, there is no objection to a consumer using a phase converter. It should be emphasized, however, that the phase converter must be properly tailored to the load to get the desired results.

The phase converter should be considered as strictly a consumer device the same as any other appliance or motor.

REA does not recommend the use of consumer devices that do not bear evidence of Underwriters' Laboratories approval. The Henry Phase Converter has not been approved by Underwriters' Laboratories, therefore REA does not recommend its use.